Subject : Instrumentation

Title : Detection of Electromagnetic Waves and Photons From the Universe

Lecturer : Shan Wenlei (Advanced Technology Center)

Outline :

In this lecture, I will help the audience make connections between instrumental studies and astronomical studies through two case studies. The first case is about the detection of cosmic microwave background (CMB) photons using superconducting transition edge detectors. The characteristics of these CMB photons carry decisive information about the history of early Universe. The second study is about superconducting tunnel junctions as heterodyne detectors, which are used in the detection of spectral line radiation from molecules that form new stars. The characteristics of the spectral lines convey precise physical and chemical information about the radiating species, thus revealing the mechanism of star formation. Moreover, I will provide an overview of cutting-edge studies on superconducting receivers for radio astronomical observations and the challenges of high-sensitivity, broadband and wide field of view detection of photons and electromagnetic waves.

Learning objectives :

1. To obtain background information about astronomical instruments.
2. To arouse interests in instrumental development.

Textbooks and references :

1. P. J. T. Peebles and David T. Wilkinson, "The primeval fireball," Scientific American, 1967
2. K. Rohlfs, T. L. Wilson, *Tools of Radio Astronomy*, Springer.